

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 8

PATENT NO. : 7,331,012
 APPLICATION NO. : 10/634,723
 ISSUE DATE : February 12, 2008
 INVENTOR(S) : Bane Vasic et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 6, lines 28–31, please delete:

" 0*(11111111111111)+1*(000000001111111)+1*(0000111100001111)+0*(0011001100110011)+
 0*(0000000000001111)+0*(0000000000110011)+0*(0000000001010101)=(0000111111110000). "

and insert therefore:

-- 0*(111111111111111)+1*(000000001111111)+1*(0000111100001111)+0*(0011001100110011)+
 0*(0101010101010101)+0*(0000000000001111)+0*(00000000000110011)+
 0*(0000000001010101)=(0000111111110000). --

At col. 6, lines 28–31, please delete:

"FIG. 3 illustrates a communication circuit 10 according to the present inventiow. The communication circuit 10 includes an RM-encoder 12, a partial-response channel 14, and a Reed-Muller partial response decoder 16 (RM-PR 16). For simplicity, a transmission of a single codeword m is shown, though the same principle of operation holds for every message word transmitted. As shown, codeword m is input into the RM encoder 12, which generates an RM-encoded codeword x . RM-encoded codeword x is transmitted over the Partial-Response (PR) channel 14, which tends to introduce noise to the codeword x such that the received codeword y contains unknown errors. As shown, the received codeword y is input into the RM-PR decoder 16, which produces an output decoded codeword."

and insert therefore:

-- FIG. 3 illustrates a communication circuit 10 according to the present invention. The communication circuit 10 includes an RM-encoder 12, a partial-response channel 14, and a Reed-Muller partial response decoder 16 (RM-PR 16). For simplicity, a transmission of a single codeword m is shown, though the same principle of operation holds for every message word transmitted. As shown, codeword m is input into the RM encoder 12, which generates an RM-encoded codeword x . RM-encoded codeword x is transmitted over the Partial-Response (PR) channel 14, which tends to introduce noise to the codeword x such that the received codeword y contains unknown errors. As shown, the received codeword y is input into the RM-PR decoder 16, which produces an output decoded codeword.
 --

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It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 9, lines 15–16, please delete:

" The interleaver 18 orders re-orders the RM-encoded codeword x prior to passing the codeword x to the partial-response channel 14. "

and insert therefore:

– – The interleaver 18 randomly re-orders the RM-encoded codeword x prior to passing the codeword x to the partial-response channel 14. – –

At col. 10, lines 42–46, please delete:

" The BCJR or SOVA device 20A has no initial reliability vector $\lambda(\hat{m})$ associated with the received code word y , so the second input of the BCJR or SOVA device 20A is a reliability vector $\lambda(\hat{x})$ of value zero, providing no indication of reliability. "

and insert therefore:

– – The BCJR or SOVA device 20A has no initial reliability vector $\lambda(\hat{x})$ associated with the received code word y , so the second input of the BCJR or SOVA device 20A is a reliability vector $\lambda(\hat{x})$ of value zero, providing no indication of reliability. – –

At col. 11, lines 34–35, please delete:

" corresponding to G_j (with) message word bits $x_s^{(j)}$ having index s such that "

and insert therefore:

– – corresponding to G_j (with message word bits $x_s^{(j)}$ having index s such that – –

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It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 11, lines 50–57, please delete:

" In each array P_s , each column shows the locations of the code bits to be added together to give an estimation of the message bit x_s . This addition is modulo-2 addition. In the hard-coding version, the message bit is determined by a majority vote among all 2^{m-j} estimations, (as described above), and the received code vector is updated according to the relation $y \leftarrow y \times x^{(j)} G_j$, and then passed to the next decoding step (step $j+1$). "

and insert therefore:

-- In each array P_s , each column shows the locations of the code bits to be added together to give an estimation of the message bit $x_s^{(j)}$. This addition is modulo-2 addition. In the hard-coding version, the message bit is determined by a majority vote among all 2^{m-j} estimations, (as described above), and the received code vector is updated according to the relation $y \leftarrow y + x^{(j)} G_j$, and then passed to the next decoding step (step $j+1$). --

At col. 11, lines 62–64, please delete:

" $LLR(b_s) = \log \left(\frac{\text{Probability}(b_s = +1|y)}{\text{Probability}(b_s = -1|y)} \right)$ "

and insert therefore:

-- $LLR(b_s) = \log \left(\frac{\text{Probability}(b_s = +1/y)}{\text{Probability}(b_s = -1/y)} \right)$ --

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At col. 12, lines 5–32, please delete:

$$\mu(\hat{m}_s^{i,j}) = -S_s^{i,j} \cdot \log \left\{ -\tanh \left(\frac{A_s^{i,j}}{2} \right) \right\} \quad (1)$$

$$S_s^{i,j} = \prod_i \text{sign}\{u(\hat{x}_l^{i,j,s})\} \quad (2)$$

where $\mu(\hat{x}_l^{i,j,k})$ is the LLR of the expression for the s-th message bit from the i-th equation in the j-th level, and where

$$A_s^{i,j} = \sum_l \log \left| \tanh \left(\frac{\mu(\hat{x}_l^{i,j,s})}{2} \right) \right|. \quad (3)$$

and "

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At col. 12, lines 5–32, please insert therefore:

$$-- \quad \mu(\hat{m}_s^{i,j}) = -S_s^{i,j} \cdot \log \left\{ -\tanh \left(\frac{A_s^{i,j}}{2} \right) \right\} \quad (1)$$

where $\mu(\hat{x}_l^{i,j,s})$ is the LLR of the expression for the s-th message bit from the i-th equation in the j-th level, and where

$$S_s^{i,j} = \prod_l \text{sign}\{\mu(\hat{x}_l^{i,j,s})\} \quad (2)$$

and

$$A_s^{i,j} = \sum_l \log \left| \tanh \left(\frac{\mu(\hat{x}_l^{i,j,s})}{2} \right) \right|. \quad (3) --$$

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It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

At col. 12, lines 56–63, please delete:

" In the hard decoding version (Reed algorithm), a message bit is determined by a majority vote, and the received code vector is updated using the expression $y \leftarrow y \oplus x^{(j)} G_j$ given above, and then passed to the next decoding step. In the soft decoding version, prior to advancing to the next row of the decoder **16**, the updated message bit likelihoods must be converted to the code bit likelihoods. This conversion is performed based on the submatrix G_j . "

and insert therefore:

-- In the hard decoding version (Reed algorithm), a message bit is determined by a majority vote, and the received code vector is updated using the expression $y \leftarrow y + x^{(j)} G_j$ given above, and then passed to the next decoding step. In the soft decoding version, prior to advancing to the next row of the decoder **16**, the updated message bit likelihoods must be converted to the code bit likelihoods. This conversion is performed based on the submatrix G_j . --

At col. 13, lines 26–27, please delete:

" Suppose that the nonzero positions of the l -th column of G_j are given by the set $\{l_1 \dots l_t\}$ where "

and insert therefore:

-- Suppose that the nonzero positions of the l -th column of G_j are given by the set $\{l_1 \dots l_t\}$ where --

At col. 13, lines 63–65, please delete: " $\lambda(\hat{x}_l) = \left[\prod_j \text{sign}\{u(\hat{m}_{l_j})\} \right] \cdot \min_j \{|\mu(m_{l_j})|\}$ "

and insert therefore: -- $\lambda(\hat{x}_l) = \left[\prod_j \text{sign}\{\mu(\hat{m}_{l_j})\} \right] \cdot \min_j \{|\mu(m_{l_j})|\}$ --

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It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

$m_{10} = c_0 + c_1 + c_{2+c3}$

At col. 14, lines 46–56, please delete: " $m_{10} = c_4 + c_5 + c_{6+c7}$ **"**

$m_{10} = c_8 + c_9 + c_{10+c11}$

$m_{10} = c_{12} + c_{13} + c_{14+c15}$

$m_{10} = c_0 + c_1 + c_2 + c_3$

and insert therefore: -- $m_{10} = c_4 + c_5 + c_6 + c_7$ **--**

$m_{10} = c_8 + c_9 + c_{10} + c_{11}$

$m_{10} = c_{12} + c_{13} + c_{14} + c_{15}$

At col. 14, lines 63–66, please delete: " $P_{10} = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 13 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$ **"**

and insert therefore: -- $P_{10} = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 13 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$ **--**

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At col. 15, lines 10–15, please delete: " $P_1 = \begin{bmatrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 8 & 9 & 10 & 11 & 12 & 13 & 14 & 15 \end{bmatrix}$ "

and insert therefore: -- $P_1 = \begin{bmatrix} 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 8 & 9 & 10 & 11 & 12 & 13 & 14 & 15 \end{bmatrix}$
 $P_0 = [0 \ 1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11 \ 12 \ 13 \ 14 \ 15]$ --

At col. 15, lines 20–30, please delete: " $P_5 = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 12 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$ "

and insert therefore: -- $P_5 = \begin{bmatrix} 0 & 4 & 8 & 12 \\ 1 & 5 & 9 & 13 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \end{bmatrix}$ --

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